CHAPTER 1

GENERAL INFORMATION

1.1 STANDARD ABBREVIATIONS

Admixture	adm
Amber Durum wheat	adu
Animal filth	anfl
Angoumois moths	moth
Badly stained	bads
Badly weathered	badw
Barley	bly
Bird excreta	brdx
Bleached	blch
Blight	blit
Blue aleurone	blal
Blue barley	blb
Blue Malting barley	blmb
Bottom not sampled	bns
Bright	brit
Broken corn	bc
Broken corn and foreign material	bcfm
Broken glass	glas
Broken kernels	bn
Broken kernels and foreign material	bnfm
Canola	k
Castor beans	cstb
Choice	ch
Class	cl
Coarse	crse
Cockleburs	cbur
Commercially objectionable foreign odor	cofo
Contrasting classes	ccl
Conspicuous admixture	cadm
Corn	c
Crotalaria	crot
Cultivated sunflower seed	csf
Damaged kernels	dk
Damaged kernels (total)	dkt
Dark, Hard, and Vitreous	dhv
Dark Northern Spring wheat	dns
Defects (total)	def
Dehulled	dh
Dent	dent
Diatomaceous earth	diat
Distinctly discolored	disc
Distinctly green kernels	dgk
Distinctly low quality	dlq
Dockage	dkg
Durum wheat	du
Dyed	dyed
Ergoty	erg
Erucic acid	erc
Extra heavy	ehvy
Fine foreign material	fine
Flaxseed	flax
Flint	flin
Frost-damaged kernels	fdk
Flint and Dent	flad
Foreign material	fm
Foreign material other than rye	fmor
Foreign material other than wheat	fmow
Foreign material other than wheat or rye	fmwr
Garlic bulblets	garb
Garlicky	gar
Glucosinolates	gluc
Grain	gr
Handpicked	hp
Handpicked foreign material	hpfm
Hard Amber Durum wheat	hadu
Hard Kernels	hard
Hard Red Spring wheat	hrs
Hard Red Winter wheat	hrw

Hard and Vitreous Kernels of Amber Color	hvac
Hard White wheat	hdwh
Heat-damaged kernels	ht
Heating	htg
Heavy	hvy
Inconspicuous admixture	iadm
Insect-damaged kernels	idk
Infested	inf
Injured-by-frost	ibf
Injured-by-heat	ibht
Injured-by-mold	ibm
Large stones, etc.	lgst
Light garlicky	lgar
Light smutty	lsm
Limed	lime
Machine-separated broken kernels and foreign material	msfm
Malting barley	mb
Materially weathered	mwth
Mechanically separated dockage	mdkg
Mixed	x
Mixed corn	xc
Mixed grain	xgr
Mixed sorghum	xs
Mixed soybeans	xsb
Mixed wheat	xwht
Moisture	m
Mold-damaged kernels	mdk
Musty	must
Northern Spring wheat	ns
Not standardized grain	nsg
Oats	o
Odor	odor
Oil	oil
Other classes	ocl
Other colors	ocol
Other damaged kernels	odk
Other grains	og
Other live insects injurious to stored grain	oli
Other types	ot
Other White wheat	owh
Plump	pl
Protein	prot
Purple mottled or stained	pms
Red Spring wheat	rs
Rodent excreta	rodx
Rye	rye
Sample grade	sg
Sclerotinia	sct
Scoured	scor
Shrunken and broken kernels	shbn
Similar seeds	ss
Six-rowed barley	srb
Six-rowed Malting barley	srmb
Six-rowed Blue Malting barley	srbm
Slightly weathered	slw
Skinned and broken kernels	skbn
Smut balls	sbal
Smutty	smut
Soft Red Winter wheat	srw
Soft White wheat	swh
Sorghum	s
Sound barley	sbly
Sound oats	so
Sour	sour
Soybeans	sb
Soybeans of other colors	sboc
Splits	spl
Stained	stnd
Stinkbug damaged	skd
Stones	ston
Stress cracks	sc
Subclass	scl
Suitable malting type	smt
Sulfured	sulf
Sunflower seed	sf
Tannin sorghum	tans
Test weight	tw
Thin	thin
Total other material	tom
Treated	tret
Triticale	trit
Two-rowed barley	trb
Two-rowed Malting barley	trmb

Unclassed wheat	uncl
Unknown foreign substance	fsub
Unsuitable malting type	umt
Washed	wash
Waxy	waxy
Weevils (live)	lw
Western White wheat	wwh
Wheat	wht
Wheat of other classes	wocl
White aleurone	whal
White Club wheat	whcb
White corn	whc
White sorghum	whs
White wheat	ww
Wild buckwheat	wb
Wild brome grass seed	wbg
Wild oats	wo
Yellow corn	yc
Yellow soybeans	ysb

NOTE: Abbreviations may be expressed in upper or lower case.

1.2 VISUAL GRADING AIDS

a. General. The visual grading aids system assists inspectors in making subjective grading decisions. This system consists of interpretive line slides and interpretive line prints. Reference is made to visual grading aids throughout this book.

b. Interpretive Line Slides and Prints. The interpretive line slides (ILS) system consists of a portable tabletop transparency viewer and photographic slide transparencies. The viewer uses a precisely controlled light source of low intensity designed to provide a standard picture and to protect the slide. Therefore, only use the special viewer for ILS. Other light sources, such as a regular slide projector,

may provide a distorted picture and damage the ILS. Use of such a projector is not prohibited; however, once used in this manner, the slides may not be used for official purposes.

Interpretive line prints (ILP) are used as an aid in making subjective grade determinations on general appearance. A special sample box is used to compare the grain being graded with the ILP. To compare the sample with the ILP, place the 5 x 7-inch photographic print in one side of the box and the grain in the opposite side. This allows for the comparison of the grain and the ILP under similar conditions. On the reverse side of each print is an explanation of the condition illustrated on the photograph and procedures for use of the photograph and box. ILS and ILP are available for viewing at FGIS field offices.

The Seedburo Equipment Company is responsible for the production and distribution of ILS, ILP, Slide Viewers, and Interpretive Line Slide Test Strips. Direct all correspondence and orders concerning these items to:

Seedburo Equipment Company
1022 W. Jackson Boulevard
Chicago, IL 60607
Telephone: (Business) - (312) 738-3700
(Orders) - 1-800-284-5779

INTERPRETIVE LINE SLIDES

Barley

B-1.0 Blight and/or mold
B-2.0 Damaged (malted)
B-3.0 Injured-by-frost
B-3.1 Frost damage
B-4.0 Germ damage
B-5.0 Injured-by-heat
B-5.1 Heat damage
B-6.0 Insect (weevil bored)
B-7.0 Injured-by-mold
B-8.0 Sprout damage

Corn

C-1.0 Blue-eye mold
C-1.1 Purple plumule
C-2.0 Cob rot
C-3.0 Drier damage
C-4.0 Germ damage
C-4.2 Not germ damage
C-5.0 Drier-heat
C-5.1 Heat-white
C-5.2 Heat-yellow
C-6.0 Insect damage
C-7.0 Mold damage
C-7.1 Dirt (not damage)
C-7.2 Mold (pink)
C-8.0 Silk cut
C-9.0 Sprout damage
C-10.0 Surface mold (blight)
C-11.0 Surface mold (more than slight)

Flaxseed

F-1.0 Damaged (bee wings)
F-2.0 Damaged by heat
F-3.0 Heat damage

Insects

IN-1.0 Granary weevil
IN-2.0 Rice weevil
IN-3.0 Maize weevil
IN-4.0 Lesser grain borer
IN-5.0 Larger grain borer
IN-6.0 Angouimois grain moth
IN-7.0 Rice moth
IN-8.0 Indian meal moth
IN-9.0 Mediterranean flour (mill) moth
IN-10.0 Warehouse, cocoa, or tobacco moth
IN-11.0 Tropical warehouse (almond) moth
IN-12.0 Cadelle
IN-13.0 Saw-toothed grain beetle
IN-14.0 Rusty grain beetle
IN-15.0 Red flour beetle and confused flour beetle
IN-16.0 Yellow and dark mealworm beetle
IN-17.0 Khapra beetle
IN-18.0 Carpet beetle
IN-19.0 Black carpet beetle
IN-20.0 Cigarette beetle
IN-21.0 Drugstore beetle
IN-22.0 Australian spider beetle
IN-23.0 Dried bean beetle
IN-24.0 Vetch bruchid
IN-25.0 Red and gray sunflower weevil
IN-26.0 Psocids
IN-27.0 Flour mite
IN-28.0 Bracon hebetor (parasitoid)
IN-29.0 Ansiopteromalus calandrae (parasitoid)
IN-30.0 Warehouse pirate bug (predator)

Oats

O-1.0 Ground/weather damage
O-2.0 Germ damage
O-3.0 Heat damage
O-4.0 Insect damage
O-5.0 Sprout damage

Other Factors

OF-1.0 Animal filth
OF-2.1 Skinned and broken
OF-2.2 Wild brome grass
OF-2.3 Barley, Six-row
OF-2.4 Barley, Two-row
OF-3.0 Castor beans
OF-4.0 Chess
OF-5.0 Cob joints
OF-6.0 Cocklebur
OF-7.0 White corn (straw)
OF-7.1 Mixed corn (straw)
OF-7.2 White capped Yellow corn
OF-7.3 Flint and dent corn
OF-7.4 Sweet and popcorn
OF-7.5 Other colors
OF-7.6 White corn (light pink)
OF-7.7 Mixed corn (pink in color)
OF-7.71 Mixed corn (purple pigmented)
OF-7.8 Slightly yellow
OF-7.9 Waxy
OF-7.91 Nonwaxy
OF-8.0 Crotalaria seeds
OF-8.1 Velvet leaf
OF-9.0 Cultivated buckwheat
OF-10.0 Einkorn
OF-11.0 Emmer
OF-12.0 Ergot
OF-13.0 Green garlic bulblets
OF-13.1 Dry garlic bulblets
OF-14.0 Guar
OF-15.0 Hull-less barley
OF-16.0 Nongrain sorghum

Other Factors (Cont.)

OF-17.0 Pink wheat
OF-18.0 Polish wheat
OF-19.0 Poulard wheat
OF-20.0 Rice
OF-21.0 Safflower
OF-22.0 Smut balls
OF-23.0 Smut (tagged ends)
OF-24.0 Spelt
OF-25.0 Sunflower
OF-26.0 Triticale
OF-27.0 Wild buckwheat
OF-28.0 Wild oats
OF-30.0 Threshed & Unthreshed
OF-31.0 Suspected fertilizer
OF-32.0 Sclerotia
OF-33.0 White sorghum
OF-34.0 Cottonseed

Rapeseed

RAPE-1.0 Distinctly green
RAPE-2.0 Heat damage
RAPE-3.0 Other damage
RAPE-4.0 Sprout damage

Rye

RY-1.0 Germ damage (sick and/or mold)
RY-3.0 Sprout damage
RY-3.1 Bran removed (not sprout)
RY-3.2 Insect chewed/sprout damage
RY-4.0 Insect (weevil bored)
RY-5.0 Other damage

Safflower

SAF-1.0 Badly ground/weather damage
SAF-2.0 Sprout damage

Sorghum

S-1.1 Damage (bleach)
S-2.0 Ground/weather damage
S-3.0 Heat damage
S-4.0 Insect bored
S-5.0 Mold damage

Sorghum (Cont.)

S-5.1 Mold damage (internal)
S-6.0 Sprout damage
S-7.0 Split germ (sound)
S-8.0 Purple pigmented
S-9.0 Tannin sorghum

Soybeans

SB-1.0 Ground/weather damage
SB-1.1 Badly ground and/or weather damage (grey/black)
SB-2.0 Damaged by heat
SB-3.0 Frost damage (green)
SB-3.2 Frost (waxy)
SB-5.0 Heat damage
SB-6.0 Immature (wafer)
SB-7.0 Insect (weevil)
SB-8.0 Mold damage
SB-8.1 Mold damage (pink)
SB-9.0 Sprout damage
SB-10.0 Stinkbug damage
SB-12.0 Soybeans of other colors
SB-13.0 Shriveled and wrinkled

Sunflower Seed

SS-1.0 Damaged-by-heat
SS-2.0 Heat damage
SS-3.0 Mold damage

Wheat

W-1.0 Black tip
W-2.0 Blight (scab)
W-3.0 Frost (blistered)
W-3.1 Frost (candied)
W-3.2 Frost (black or brown)
W-3.3 Frost (flaked)
W-4.0 Germ damage (sick)
W-4.1 Germ damage (mold)
W-4.2 Germ damage (bleach method)
W-5.0 Green (immature)
W-6.0 Heat damage (Durum)
W-6.1 Heat damage (other than Durum)
W-7.0 Other damages
W-8.0 Sprout damage
W-8.1 Insect chewed/sprout damage
W-9.0 Insect bored (weevil)
W-9.1 Insect chewed

The following is a list of the available interpretive line prints:

Soybeans -	Purple mottled or stained by growth of a fungus
	Purple mottled or stained by dirt or dirt-like substance
	Purple mottled or stained by pokeberry stain
Sorghum -	Distinctly discolored (sorghum/tannin and white appearance)
	Distinctly discolored (white appearance)
	Distinctly discolored (sorghum or tannin appearance)
	Badly weathered (sorghum/tannin and white appearance)
	Badly weathered (white appearance)
	Badly weathered (sorghum or tannin appearance)
Oats -	Slightly weathered
	Materially weathered

c. Interpretive Line Slide Viewer. The S/J viewer was designed with a light source that will not harm the slide and provide inspectors with a standard reference image. The following recommendations are provided to promote uniformity in the projected image and to prolong life of the slide.

(1) Use the center three windows of the viewer when viewing slides. The intensity of the light that is emitted from the outer edges of the fluorescent bulb is the first to diminish as the bulb ages. Depending on the degree of loss, use of the outer windows could result in the misapplication of the intended interpretive line. Restricting the use of available windows will minimize the risk of this occurring.

(2) Periodically, check the condition of the bulb and remove any accumulated dust and replace the bulb if the outer edges show signs of aging (blackening).

(3) Review one slide at a time and do not leave slides on the viewer when not in use or for prolonged periods of time. Return slides to the slide case/drawer at the end of the viewing session.

d. Miscellaneous Aids. Inspectors may use a magnifying glass or similar device for visual identification of small objects.

1.3 WORK RECORDS

FGIS personnel shall use Forms FGIS-920, "Grain Sample Ticket," FGIS-918, "Sample Pan Ticket," FGIS-919, "Sampling Ticket," or FGIS-921, "Inspection Log," to record all sampling and inspection information.

Agency personnel shall use similar work forms to record all sampling and inspection information.

1.4 PRELIMINARY EXAMINATIONS

Inspection personnel sampling grain must: (1) observe the uniformity of the grain as to kind, quality, and condition; (2) draw an original sample; and (3) report the results to the inspector.

The inspector must consider the sampler's observations when determining the representativeness of the sample. If the inspector suspects the sample is not representative, the inspector should consult with the sampler and, if necessary, dismiss the inspection or arrange to obtain another sample.

1.5 DEFINITIONS

a. File Sample. A representative portion of an official sample (approximately 1,300 grams or more).

b. Identity (Kind of Grain). A determination as to whether a sample meets the definition of a specific grain or oilseed as established in the Official U.S. Standards for Grain.

c. Representative Portion. A part or limited quantity of grain separated from the original sample by means of an approved device.

d. Representative Sample. The terms "Representative Sample" and "Original Sample" are used interchangeably in the Grain Inspection Handbook and refer to a sample of approximately 2,500 grams in size drawn from a grain lot by official inspection personnel using approved procedures and sampling devices. See Book I, Sampling, for further information on sampling.

e. Work Sample. A representative portion of grain of sufficient size (approximately 1,000 - 1,050 grams) to make determinations required for a particular grain.

f. Review Inspection. A reinspection, appeal inspection, or Board appeal inspection service.

1.6 BASIS OF DETERMINATION

Each chapter in Grain Inspection Handbook, Book II, provides a definition for basis of determination which establishes the rules for testing/analyzing all factors. Do not analyze any factor until the basis for making the determination is known.

1.7 SUBMITTED SAMPLE INSPECTIONS

According to section 800.80(a)(4) of the regulations under the United States Grain Standards Act, "A submitted sample inspection service shall be based on a submitted sample of sufficient size to enable official personnel to perform a complete analysis for grade. If a complete analysis for grade cannot be performed because of an inadequate sample size or other conditions, the request for service shall be dismissed or a factor only inspection may be performed upon request." For the purpose of providing a complete inspection, due to the requirement that the test weight of the grain be shown on each certificate for grade, "sufficient size" is defined as being of sufficient quantity to overflow the test weight kettle (minimum). Samples containing less than this amount shall be limited to factor(s) only inspection.

The amount of sample required to be submitted for a factor(s) only inspection depends on the factor(s) information being requested. Certain objective factors/official criteria (e.g., moisture and protein/oil content) require specific quantities of grain in order for the equipment used in the determination to function properly. Whenever the amount of grain used in these determinations deviates from the prescribed amount, the accuracy of the determination is sacrificed. Consequently, inspection requests for samples containing less than these specified amounts must be dismissed.

For factors not dependent on equipment requiring specific portion sizes, the amount of sample submitted for factor only inspections may vary since the inspection results only represent the amount of grain submitted. The analysis of a submitted sample for subjective factors (e.g., damage and foreign material) or other objective factors (e.g., dockage and shrunken and broken kernels) is not compromised through the use of portion sizes which are less than those specified in individual chapters of this handbook. Consequently, unless restricted by equipment performance requirements, factor only inspection requests may be performed on submitted samples which contain less grain than the portion size prescribed in this handbook.

1.8 DISCLAIMER CLAUSE

The mention of firm names or trade products does not imply that they are endorsed or recommended by the United States Department of Agriculture over other firms or similar approved products not mentioned.

1.9 BOERNER DIVIDER

The Boerner divider reduces the size of a grain sample while maintaining the representativeness of the original sample. Use the Boerner divider, or a divider that gives equivalent results, when reducing a sample to the portion size required for a specific test/analysis.

a. General Operating Procedures.

(1) Check the divider for condition and cleanliness.

(2) Close the hopper valve.

(3) Place empty collection pans under the discharge spouts.

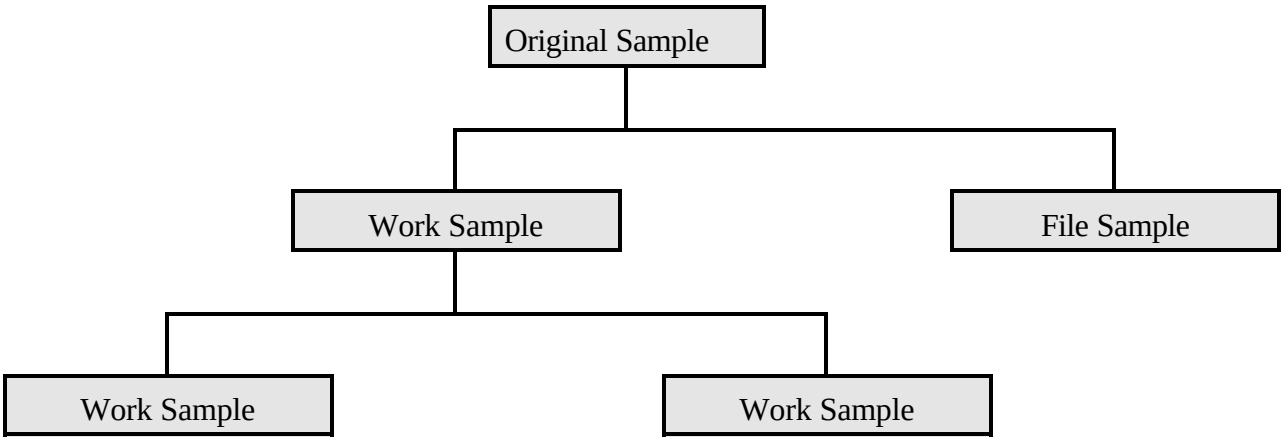
(4) Pour the sample into the hopper.

(5) Open the valve quickly. For large samples, feed more grain into the hopper during the dividing process.

For more specific information on the operation, maintenance, and performance testing of Boerner dividers, see chapter 7 of the Equipment Handbook.

b. Processing the Original Sample: Use the Boerner divider to subdivide the original sample into a file sample and appropriate work samples.

Chart - Processing Original Sample



c. Processing the Work Sample: Refer to the individual grain chapters for specific information on processing the work sample.

1.10 MOTOMCO MOISTURE METER

Water content in grain is determined by an approved device according to procedures prescribed in FGIS instructions. Refer to the individual grain chapters for the basis of determination and portion size.

Use only the Motomco moisture meter to determine the percentage of moisture. See the FGIS Moisture Handbook.

General Operating Procedures:

a. Conversion Charts. Conversion charts for the Motomco moisture meter provide portion sizes, calibration settings, conversion of meter readings to moisture percentages, and temperature corrections.

b. Weighing the Sample. Pour the sample through the Boerner divider at least once before weighing the required portion size. When weighing a sample, do not add grain by pouring it into the scale scoop until the balance tips. Instead, add or remove a few kernels of grain from the scale scoop with your finger tips until the scale is balanced. A 1.0-gram error in weight produces an error of 0.15 percent in the moisture determination; therefore, it is important to be accurate.
Place the portion in an approved moisture-proof container. Insert the rubber-stoppered thermometer or probe.

c. Type of Container. Do not use paper bags, fiber cartons, etc., as containers for moisture samples because they tend to draw moisture from the sample. Containers found to be most practical for retaining moisture are plastic, 1-pint containers with approximately 1-3/4-inch openings. **CAUTION**: Do not place paper **into** moisture samples because paper absorbs moisture and lowers the moisture of the grain.

d. Temperature Determination. Moisture charts are standardized for a grain temperature of 77°F; therefore, a correction factor must be applied for temperatures other than 77°F. Moisture meter conversion charts provide the appropriate correction.

Generally, leave the thermometer in the grain for 3 to 5 minutes to obtain an accurate temperature. However, wide variations between room and grain temperatures make it difficult to predict how long the thermometer should stay in the grain before the temperature is read.

e. Cold Samples. Cold weather presents some unusual problems in the handling and preparation of samples for moisture determination. Exposure of cold samples to warm air results in moisture condensation, which leads to inaccurate moisture results.

Place cold samples in sealed, moisture-proof containers on a table in such a manner that permits free air access to all sides and allow the sample to warm up to within 20 degrees of room temperature before testing.

f. Meter Calibration. To account for possible temperature and humidity changes, calibrate the meter at least hourly during regular use or before each use when moisture is determined sporadically throughout the day. Leave meters on at all times. When a meter has been turned off for a considerable amount of time, such as overnight, allow at least a 1-hour warm-up period to stabilize the meter before calibrating.

To calibrate the meter, proceed as follows:

(1) Attach test cell to meter.

(2) Turn switch "on."

(3) Allow meter to warm up.

(4) Turn function switch to "CAL" (calibration) position.

(5) Refer to the Conversion Charts for Motomco Moisture Meters for the calibration setting. Rotate the dial knob until the appropriate calibration setting is observed on the dial scale. When properly read, the two hairlines on the dial scale appear as a single line.

(6) Rotate the calibration knob until the needle is at its lowest (null point) position on the milliammeter.

(7) Turn function switch to "OPR" (operate) position. The meter is now calibrated and ready for use.

g. Moisture Determination. To determine the moisture content, proceed as follows:

(1) Weigh the required sample portion on a moisture scale or a Class II scale having a division size $\leq$ 0.1 gram.

(2) Pour into moisture-proof container with thermometer or probe and allow sample to equilibrate to within 20 degrees of room temperature.

(3) Calibrate the meter.

(4) Move function switch to "OPR" (operate) position.

(5) Determine and record the temperature.

(6) Pour the sample from the container into the dump cell.

(7) Firmly push the dump cell release button.

(8) Rotate the dial knob and observe needle until it reaches its lowest (null point) position on the milliammeter.

(9) Note the dial reading. Record the reading directly beneath the two hairlines to the nearest 0.5 scale division.

(10) Refer to the appropriate conversion chart and (1) convert the meter reading into percentage of moisture and (2) make the necessary temperature correction.

(11) Maintain a moisture record of the grain temperature and the dial reading for all moisture determinations.

For more specific information on the operation, maintenance, and performance testing of moisture meters, see the Moisture Handbook.

1.11 TEST WEIGHT PER BUSHEL APPARATUS

Test weight per bushel is the weight per Winchester bushel (2,150.42 cubic inches) as determined using an approved device.

The determination for test weight is made on a portion of sufficient quantity to overflow the kettle. Before making a determination, refer to the chapter covering the grain being tested for the basis of determination and certification requirements.

General Operating Procedures:

a. Level and balance the test weight per bushel apparatus.

b. Close the hopper valve.

c. Pour the work sample into the hopper.

d. Center the hopper over the kettle.

e. Fill the kettle by opening the hopper valve quickly.

f. Move the hopper all the way to the left before proceeding. Do not jar the apparatus. Jarring could cause inaccurate results.

g. Using a standard stroker, stroke the kettle by holding the stroker in both hands with the flat sides in a vertical position. Level the grain in the kettle by making three full-length, zigzag motions with the stroker.

h. Convert the weight of the sample by either the "standard" method or one of the "alternate" methods.

   (1) Standard Method. Carefully hang the kettle on the beam and move the weights until the beam is balanced. Read the test weight per bushel scale.

   (2) Alternate Method - Manual Conversion. Pour the sample from the kettle onto a general class scale, note the weight of the sample, find the gram weight on the test weight conversion chart (see Appendix), and read the corresponding test weight per bushel shown to the right of the gram weight.

(3) Alternate Method - Automatic Conversion. When using an electronic scale programmed to convert gram weight to either pounds per bushel or kilogram per hectoliter, select the appropriate test weight mode. Place an empty sample pan or the test weight kettle on the scale and zero the scale. Pour the sample from the kettle into the sample pan or place the filled kettle onto the scale as appropriate. Read the result from the test weight mode selected.

(4) Conversion pounds/bushel to kilograms/hectoliter

For Durum wheat, use the formula: (lb/bu x 1.292) + 0.630 = kg/hl

Example:

- Pounds per bushel result = 60.0 lbs/bu
- (60.0 lb/bu x 1.292) + 0.630 = kg/hl
- 77.52 lb/bu + 0.630 = 78.15 kg/hl
- Rounded to nearest tenth = 78.2 kg/hl

For all other types of wheat, use the formula: (lb/bu x 1.292) + 1.419 = kg/hl

Example:

- Pounds per bushel result = 58.4 lbs/bu
- (58.4 lb/bu x 1.292) + 1.419 = kg/hl
- 75.45 lb/bu + 1.419 = 76.87 kg/hl
- Rounded to nearest tenth = 76.9 kg/hl

For all other grains, use the formula: lb/bu x 1.287 = kg/hl

Example:

- Pounds per bushel result + 54.541 (electronic scale), disregard fraction of a pound and round to 54.5 lb/bu.
- 54.5 lb/bu x 1.287 = 70.14 kg/hl
- Rounded to nearest tenth = 70.1 kg/hl.

Record 54.5 lbs on the certificate; and, in the "Remarks" section, record the approximate metric equivalent as 70.1 kg/hl.

NOTE: **While all grain samples may be weighed and converted to pounds per bushel using these electronic programmed scales, DO NOT use these scales to convert gram weight to kilograms per hectoliter for wheat, as they are only programmed using the 1.287 conversion factor referenced above.**

i. Record the test weight per bushel on the work record and certificate as prescribed for the particular grain being tested. (Refer to the appropriate grain chapter in this handbook.) If requested, record the test weight results in kg/hl.

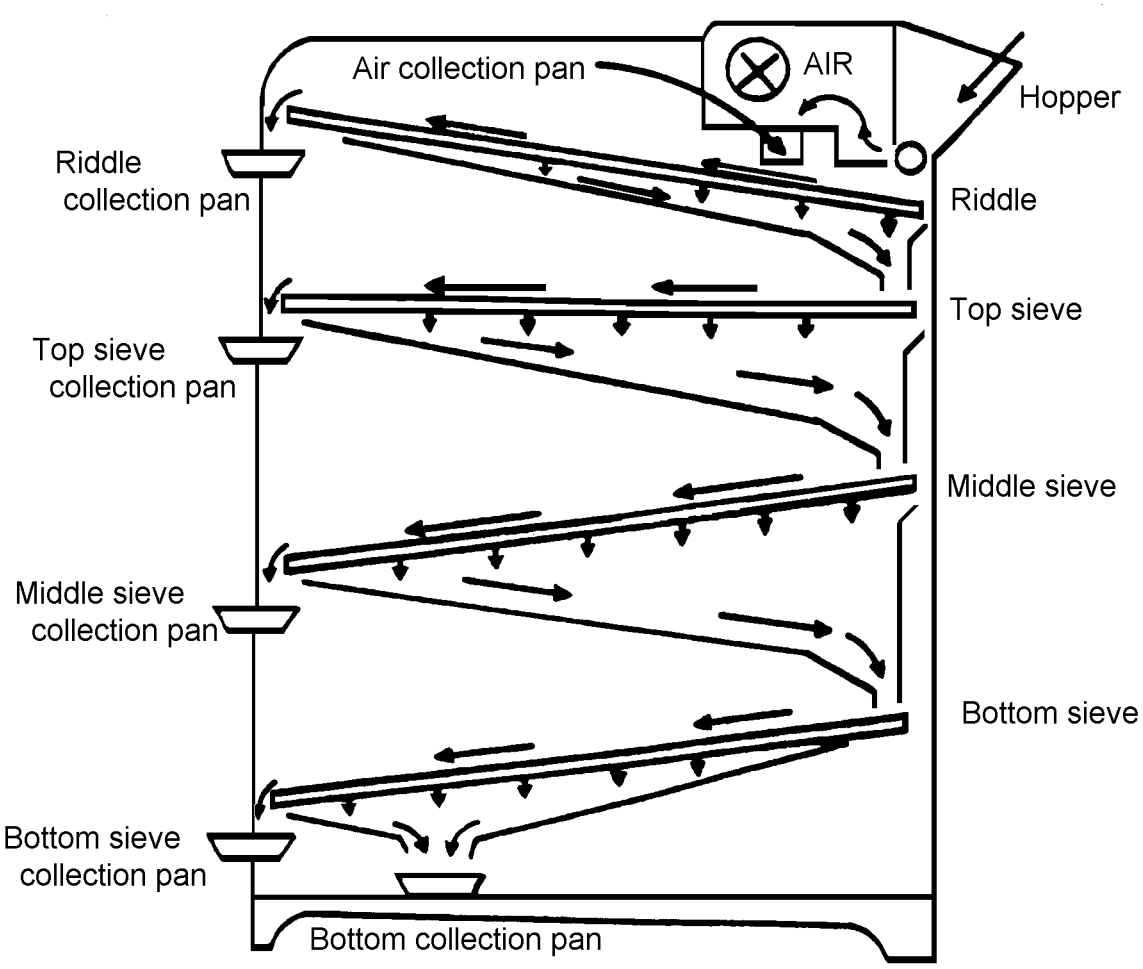
Upon request, show the test weight per bushel result to the nearest tenth pound in the "Remarks" section of the certificate.

For more specific information on the operation, maintenance, and performance testing of the test weight per bushel apparatus, see chapter 5 of the Equipment Handbook.

1.12 CARTER DOCKAGE TESTER

The Carter dockage tester uses aspiration (air) and a combination of riddles and sieves to prepare samples for grading by removing the readily separable foreign matter. Generally, the foreign material removed consists of all matter lighter, larger, or smaller than grain.

CARTER DOCKAGE TESTER FLOW CHART



General Operating Procedures:

a. Set air and feed controls at the prescribed settings.

b. Place the riddle, if applicable, and sieve(s) in the prescribed locations.

Table No. 1 lists the proper riddles, sieves, air, and feed control settings to use for each type of grain.

TABLE NO. 1

EQUIPMENT SCHEDULE & CONTROL SETTINGS

Type of Grain	Air	Feed	Riddle	Top Sieve	Middle Sieve	Bottom Sieve
Wheat other than Durum	4	6	2		2	2
Durum wheat	4	6	25		2	2
Rye	4	6	25		2	2
Corn	1	10 *		3		
Barley	4	6	6	8	6	
Flaxseed	3 ½	4	000	4	2	7
Sorghum	1	6	6	6		1
Triticale	4	6	25		2	2
Sunflower Seed	6	7 ½ *	Oil Seed (35898)	3		8
Canola	5	3	000	4		

* Setting may vary, refer to the Equipment Handbook.

Wheat, rye, and triticale have additional testing procedures when they contain excessive quantities of wild buckwheat, cob joints, chess and similar types of seeds, and flaxseed. Refer to the appropriate chapters for the limits and specific instructions on how to set the Carter dockage tester when this material is found.

c. Check the air collection pan to see if it is empty and place the collection pans in the prescribed locations.

d. Turn the tester on.

e. Pour the work sample into the hopper.

f. When all of the grain has cleared the hopper, riddle (if applicable), and sieves, turn the tester off.

g. Collect all material separated by the aspirator, riddle (if used), and sieves. Combine the material as prescribed in the chapter covering the particular grain.

For more specific information on operation, maintenance, and performance testing procedures, see chapter 4 of the Equipment Handbook.

1.13 MECHANICAL SIEVE SHAKER

The grading of certain grains requires that some portions be sieved. This is accomplished either by (1) hand or (2) mechanical sieving. Mechanical sieving is preferred over the hand-sieving method because the results are more uniform and accurate in counting the number of strokes. The mechanical sieve shaker has a range of 1 to 120 strokes, always starting and stopping in the same position. One complete stroke should take approximately 1 second.

TABLE NO. 2

FACTORS THAT REQUIRE SIEVING				
Grain	Factor	Strokes	Manufacturers' Designation Sieve Size (Inches)	Metric Conversion Millimeters
Wheat	Shrunken and Broken Kernels	30	0.064 x 3/8 oblong *	1.63 x 9.53
Barley	Thin: Barley Thin: Six-rowed Malting Barley Thin: Two-rowed Malting Barley Plump	30 30 30 30	5/64 x 3/4 slot * 5/64 x 3/4 slot * 5.5/64 x 3/4 slot * 6/64 x 3/4 slot *	1.98 x 19.05 1.98 x 19.05 2.18 x 19.05 2.38 x 19.05
Rye	Thin and Plump	30	0.064 x 3/8 oblong *	1.63 x 9.53
Soybeans	Foreign Material	5	8/64 round	3.175
Triticale	Shrunken & Broken Kernels	30	0.064 x 3/8 *	1.63 x 9.53
Oats	Thin	30	0.064 x 3/8 *	1.63 x 9.53
Sunflower Seed	Admixture	See Ch. 11	5/64 inscribed circle	1.98
Canola	Dockage	30 30 30	0.028 x 15/32 oblong 0.035 x 15/32 oblong 0.0395 x 15/32 oblong	0.71 x 11.906 0.89 x 11.906 1.0 x 11.906
* Precision sieves, refer to Equipment Handbook.				

General Operating Procedures:

a. Refer to the individual grain chapters for the basis of determination and portion size.

b. Make sure the shaker is level.

c. Select the proper sieve and place it over a bottom pan.

d. Mount the sieve and bottom pan in the sieve holder making sure that the slotted or oblong perforations are parallel with the sieving action.

e. Set the stroke counter for the required number of strokes.

f. Gently pour the representative portion of grain in the center of the sieve.

g. Turn the machine on.

h. After the required number of strokes has been completed, the machine will automatically stop.

i. Carefully remove the sieve and bottom pan. Jarring the sieve will cause the material remaining on top to pass through the perforations, leading to inaccurate results.

j. Combine the material lodged in the perforations with the material that remained on top of the sieve. To remove the lodged material from the perforations, rub the sieve bottom gently. Tapping will warp the sieve and lead to inaccurate results in future determinations.

For more specific information on the operation, maintenance, and performance testing of sieves and sieve shakers, see chapter 9 of the Equipment Handbook.

1.14 BARLEY PEARLER

The barley pearler dehulls barley and sunflower seed for certain factors. The machine uses a carborundum wheel controlled by a time switch. The wheel removes the hulls and a screen separates the hulls and powdered barley or sunflower seed hulls from the pearled barley or sunflower seed.

Barley pearlers are individually standardized by adjusting the length of time the barley remains in the pearling chamber while the wheel is in motion. Post the standardized pearling time conspicuously on each machine.

General Operating Procedures:

a. Before placing the portion into the pearler:

(1) Run the pearler and open the slide to ensure that the pearling chamber is empty.

(2) Remove and empty the drawers that catch the barley hulls and pearled portion. Replace them.

(3) Securely close the slide.

b. Pour the sample into the hopper and replace the lid.

c. Set the time for the grain being pearled.

d. After pearling, pull out the slide and allow the pearled portion to drop into the drawer. With the slide open, briefly restart the machine and clear the pearling chamber.

e. Proceed with the determination as described in the appropriate chapter of the handbook.

For more specific information on the operation, maintenance, and performance testing of barley pearlers, see chapter 8 of the Equipment Handbook.

1.15 LABORATORY SCALES

Weigh samples and portions of samples using the appropriate category of FGIS-approved laboratory scales prescribed in table 3.

TABLE NO. 3

LABORATORY SCALES			
Portion Sizes	Scale Category 1/	Maximum Division Size	Record Weights To at Least the Nearest --
120 grams or less	Precision	.01 gram	.01 gram
Samples for moisture determination	Moisture	.1 gram	.1 gram
More than 120 grams	General	1 gram	1 gram
1/ See chapter 2, Equipment Handbook, for additional information.			

1.16 ROUNDING

When certificating official results, use the following procedures for rounding unless otherwise specified.

A hand-held calculator or computer may be used to calculate results and to provide rounding.

a. If the calculating device is programmable, set the device to the number of decimal places or whole number needed for reporting on the work record or certificate. Test the results to ensure that the rounding procedure is identical to the FGIS rounding method described in b. below. Otherwise, set the calculating device to the floating mode and carry the results one decimal place further than the level required and round the final results as in b. below.

b. When the figure to be rounded is followed by a figure greater than or equal to 5, round to the next higher figure; for example, report 6.35 as 6.4, 0.45 as 0.5, etc. When the figure to be rounded is followed by a figure less than 5, retain the figure; for example, report 8.34 as 8.3, 1.22 as 1.2, etc.

Record all the information on the certificate as shown in Table No. 4 - Certificating Percentages and Test Weight.

TABLE NO. 4

CERTIFICATING PERCENTAGES AND TEST WEIGHT

Factor	Grain	How Certificated
Class	Barley	Nearest whole percent
Class and Subclass	Wheat	Nearest whole percent
Dockage	Barley, Flaxseed, and Sorghum	Whole percent, fraction disregarded
	Triticale	Whole & half percent, fraction disregarded
	Wheat, Rye	Nearest tenth percent
Ergot	All grains	Nearest hundredth percent
Foreign material and/or foreign material & fines	Mixed grain Sunflower Seed All other grains	Nearest whole percent Nearest whole & half percent **1/** Nearest tenth percent
Flint and Dent, Flint, & Waxy	Corn	Nearest whole percent
Identity (kind of grain)	All grains	Nearest whole percent
Each kind of grain	Mixed grain	Nearest whole percent
Plump	Barley	Range **2/**
Sclerotinia	Soybeans Canola	Nearest tenth percent Nearest hundredth percent
Smut	Barley	Nearest hundredth percent
Stones	Canola	Nearest hundredth percent
Test weight	Corn, Rye, Triticale, & Wheat	Whole & nearest tenth pound & whole & nearest tenth kilogram
	All other grains	Whole & half pound, fraction disregarded, & whole & nearest tenth kilogram
All other factors	All grains	Nearest tenth percent

1/ Sunflower seed foreign material is reported as follows: 0.0 to 0.24 as 0.0 percent, 0.25 to 0.74 as 0.5 percent, etc.
2/ Ranges of plump shall be: Below 50 percent, 50 to 55 percent, 56 to 60 percent, 61 to 65 percent, etc.

1.17 EQUIPMENT AND MATERIALS

The equipment and materials for performing the bleach test for determining germ-damaged kernels in sorghum and wheat and for the iodine test for determining waxy corn are as follows:

a. Safety Equipment - Bleach and Iodine Tests.

(1) Full face protection shield.

(2) Impervious plastic or rubber apron and gloves.

(3) Exhaust system.

(4) Eye wash station.

(5) Hand held spray.

b. Equipment and Materials - S/J Mixer Bleach Test. Properly functioning equipment and adherence to established procedures are vital to the successful removal of the sorghum seed coat.

(1) Potassium Hydroxide (KOH) Pellets (85-90%). KOH is a caustic chemical that functions to generate the heat necessary for the bleaching reaction to occur. Due to the hygroscropic nature (readily absorbs water) of this chemical, continued or prolonged exposure to air/moisture significantly reduces its strength. To ensure that the KOH provides satisfactory, repeatable results, it is critical to control the amount and purity of the KOH pellets used in the bleaching process.

(a) Do not use KOH pellets that appear shiny or that clump together. Such conditions indicate that the pellets have absorbed water to the extent that it will significantly reduce the KOH's heat generating capability.

(b) Between samples and at the end of the day make sure the lid is tightly secured to the jar.

(2) Sodium Hypochlorite (Bleach). Bleach serves a dual purpose in the bleaching process. It provides the moisture necessary to generate heat by dissolving the KOH pellets. It also combines with the KOH to chemically remove the seedcoat. To ensure that a satisfactory reaction occurs, control the type, amount, and concentration of bleach used in the process as follows:

(a) Measure exactly 40.0 ml of bleach using a 50- or 100-ml graduated cylinder or a dispenser. If dispensers are used, they must meet the following criteria:

- Cylinder capacity: 50 ml

- Accuracy: ± 1.0 percent

- Reproducibility: ± 0.1 percent

When ordering dispensers, make sure the plunger assembly is capable of fitting the type/size of reagent bottle you are using. Examples of dispensers meeting this criteria include the Brinkman dispensette and Repipet dispenser which are available through Fisher Scientific (1-800-766-7000), catalog number 13-688-70 and 13-687-57, respectively.

(b) Use major brands of bleach only (e.g., Clorox, Purex). Do not use regional or local brands due to the potential variations that exist in the concentration level of the bleach.

(c) To maintain a consistent concentration of bleach (5.25%), record the purchase/expiration (3 months after purchase) date of the bleach on the bottle. Replace any bleach exceeding the expiration date.

(3) Vinegar to neutralize any spilled KOH.

(4) Teaspoon.

(5) Polyethylene coated weighing paper, 3 inches in diameter.

(6) Balance.

(7) 100-ml graduated cylinder.

(8) Timer. Verify the accuracy of the timer setting immediately prior to sorghum harvest and as necessary thereafter to maintain a mixing time of 3 minutes ± 10 seconds.

(9) S/J mixer. Make sure there is no hesitation in the rotation of the stirring blade.

(a) Stir jar and assembly for S/J mixer.

(b) One extra stirring head for each mixer as well as several mixing jars are recommended.

(10) Small tea strainer.

(11) Paper towels.

(12) Drying apparatus (hair dryer modified with sieve to dry bleached kernels).

c. Equipment and materials - Iodine Test. The equipment and materials for determining waxy corn are as follows:

(1) Cutting implement:

(a) Sharp knife; or

(b) Razor blade.

(2) Spray bottle:

(a) Dark-colored, trigger-spray, polyethylene bottle; or

(b) Amber colored borosilicate glass with atomizer bulb.

(3) Petri dish or porcelain plate or other stain-resistant container.

(4) Wax paper, plastic wrap, or plastic sheets to spread on work surfaces.

(5) Iodine stock solution.

CAUTION: Protect containers of iodine (crystals and solutions) from physical damage. Perform all mixing in a well ventilated area or within the working area of a laboratory hood.

Follow steps (a) through (f) to prepare the iodine stock solution.

(a) Weigh out 10 grams of iodine crystals and 20 grams of potassium iodide crystals.

(b) Measure 1,000 ml of distilled water.

(c) Pour the distilled water into an amber-colored bottle.

(d) Dissolve the 20 grams of potassium iodide crystals in the distilled water.

(e) Add the 10 grams of iodine crystals.

(f) Mix thoroughly. Label the bottle "Iodine Stock Solution." Post poison labels on the bottles.

NOTE: Iodine crystals and potassium iodide crystals can be purchased from chemical supply companies or from pharmacies.

1.18 FILE SAMPLE RETENTION (GRAIN)

a. General. To accomplish the mission of the agency, FGIS has established the policy of maintaining an effective record management program. Part of the official record system is the maintenance of file samples retained for reference or review purposes. Reference FGIS Program Directive 9170.13, Uniform File Sample Retention System, for detailed procedures.

b. Use of File Sample. Official personnel shall establish and maintain a file sample retention system in accordance with the regulations and applicable instructions. File samples may be used for:

(1) Monitoring purposes by official personnel;

(2) Supplementary completion of the original grade (e.g., infestation, odor, etc.);

(3) Review by interested persons;

(4) Reinspections, appeals, and Board appeals;

(5) Answering trade complaints; and

(6) Training.

c. Sample Retention. Official personnel may, at their discretion, keep file samples for a period longer than required. The minimum retention periods (calendar days) are as follows:

TABLE NO. 5

FILE SAMPLE RETENTION				
	Minimum Days			
	IN	OUT	EXPORT	OTHER
Trucks	3	5	30	-
Railcars	5	10	30	-
Barges (river)	5	25	-	-
Ships & Barges (lake or ocean)	5	25	90	-
Bins & Tanks	-	-	-	3
Submitted Samples	-	-	-	3

When an agency file sample is used to complete an appeal inspection or selected for monitoring, the monitoring office shall maintain the sample for the applicable retention period.

d. Sample Size. File samples shall be of sufficient size to accommodate subsequent examinations or analysis. Samples retained for grade should be approximately 1,300 grams or more, except for the lighter grains (e.g., oats, sunflower seed, etc.), that require less grain to determine grade. For factor only tests or official criteria (e.g., wheat protein), smaller file samples should prove sufficient to handle review services. File samples larger than 1,300 grams may be retained if deemed necessary to provide subsequent inspection service.

e. Retention of Worked File Samples. If possible, retain an unworked portion of a representative sample or submitted sample as the final file. The worked portion may be retained as the final file only when insufficient sample is available for an unworked file sample.

f. File System. Official personnel must maintain a sample filing system that permits efficient retrieval of file samples and ensures adherence to required retention periods (paragraph c. above). Further, file samples must be protected against theft, manipulation, substitution, and unauthorized use.

Use large polyethylene bags, semi-rigid plastic containers, or metal containers to retain file samples. Use metal or semi-rigid plastic containers when samples contain an off odor.

g. Disposal Procedures. Official personnel must keep complete and accurate disposition records. After file samples have served their intended purpose, dispose of the grain in accordance with criteria outlined in section 800.81(e) of the regulations and applicable instructions as follows:

(1) Upon the applicant's request, return the file samples to the applicant;

(2) If the applicant does not request the return of the grain, it may be sold, donated, or destroyed; and

(3) If the grain contains toxic substances (e.g., treated seed, aflatoxin, etc.), dispose of the grain in accordance with applicable Federal, State, and local laws.

1.19 UNOFFICIAL INSPECTION SERVICES

Occasionally, official personnel receive requests from processors, producers, seed companies, etc., to perform certain analysis on grain or grain related products. While many tests differ from official determinations, some analyses are the same or very similar. The actual testing methodology used is often specified by trading rules or by the specific applicant.

Official personnel who receive requests for such analysis or service, such as seed grain testing, brown test in corn, and yield in oats, may perform the service(s) on an unofficial basis.

1.20 METRIC SYSTEM

The following tables are provided to assist in the conversion from the U.S. measurement system (inch-pound) to the metric system.

TABLE NO. 6

CONVERSIONS

A = C ÷ B			C = A x B	
Symbol	A Inch-Pound Unit	B Factor	Symbol	C Metric Unit
bu	bushels (U.S.)	35.239	hl	hectoliters
gal	gallons (U.S.)	3.785	L	liters
in	inches	25.4	mm	millimeters
lb	pounds	0.4536	kg	kilograms
lb/bu	pounds per bushel	1.287 *	kg/hl	kilograms per hectoliter
qt	quarts (dry)	1.101	L	liters
qt	quarts (liquid)	0.946	L	liters
ton	tons (short)	0.907	t	metric tons

* Use for all grains except wheat. For wheat conversion/prediction formula, see chapter 13, section 13.16.

TABLE NO. 7

EQUIVALENTS			
		Volume	
Weight	Length	Dry	Liquid
grain = 0.06 g 1 oz = 28 g l lb = 0.45 kg 1 bu = 352.4 hl 1 st = 907 kg = 0.9 t 1 lt = 1016.0 kg = 1.02 t 1 ppb = 1 μg/kg 1 ppm = 1 mg/kg	1 in = 2.54 cm = 25.4 mm 1 ft = .304 m 1 yd = 0.914 m	1 pt = 0.28 L 1 qt = 1.10 L 1 gal = 35.24 L	1 pt = 0.473 L 1 qt = 0.946 L 1 gal = 3.785 L

TABLE NO. 8

MEASURES

Pounds Per Bushel (trade weight)		Bushels Per Ton	Short	Metric (t)	Bushels to Metric Tons	
Wheat, Soybeans, Triticale	60	Wheat, Soybeans, Triticale	33.3	36.7	Wheat, Soybeans	= bu. x .027
Corn, Sorghum, Flaxseed, Rye	56	Corn, Sorghum, Flaxseed, Rye	35.7	39.4	Corn, Sorghum, Rye	= bu. x .025
Canola/Rapeseed	50	Canola/Rapeseed	40.0	44.0	Canola/Rapeseed	= bu. x .023
Barley	48	Barley	41.7	45.9	Barley	= bu. x .022
Oats	32	Oats	62.5	68.9	Oats	= bu. x .015
Sunflower Seed	24	Sunflower Seed	83.3	91.9	Sunflower Seed	= bu. x .011